

Newsletter

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Director's Note

This column often gives me the opportunity to explain the importance of long-term studies in helping to understand the complexity of natural ecosystems. The Institute recently recognized the importance of another long-term contribution: Richard Livellara's 40 years of service to The New York Botanical Garden and to the evolving programs at the Mary Flagler Cary Arboretum and the Institute of Ecosystem Studies (see page 3).

Mr. Livellara, now IES supervising maintainer, has spent his entire career making these complex facilities run smoothly and efficiently. He is one of a number of excellent employees whose tenure here is measured in decades. These employees contribute significantly to the success of the overall program, while they also provide a critical institutional memory.

The IES Newsletter is published by the Institute of Ecosystem Studies at the Mary Flagler Cary Arboretum. Located in Millbrook, New York, the Institute is a division of The New York Botanical Garden. All newsletter correspondence should be addressed to the editor.

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Ozone's Effects Linger in the Litter

"What makes scientific research exciting?" is a question that may have as many answers as there are scientists. One response that most would agree on, however, is that in scientific research new challenges and questions continually grow from those that already are on their way to being addressed and answered. Such was the case four years ago when, in the course of an informal lunch-hour seminar series at the Institute, Dr. Clive G. Jones was describing his findings on the effects of ozone on living cottonwood leaves. Dr. Stuart E.G. Findlay, whose research interests include ecological processes in stream sediments, wondered whether leaves exposed to high concentrations of ozone continued to show the effects of exposure after they fell from the trees in the autumn.

In nature, efficient breakdown of dead organic matter is critical in recycling the chemical nutrients necessary for the growth of all organisms. Nitrogen and other nutrients from leaf litter are released when decomposer organisms — microbes, fungi, insects — in the soil or in stream sediments eat those leaves. The more palatable the leaves are to decomposer organisms, the faster they decay and the faster their nutrients are freed to support new growth.

Dr. Findlay asked Dr. Jones to save cottonwood leaves that fell from his research plants to use in studies of "after-life" effects. Dr. Findlay mixed the leaves with microbes collected from stream leaf litter and observed decomposition under controlled conditions in the Institute laboratories. He found that ozone-exposed leaves decomposed more slowly than untreated leaves.

This finding suggests that leaves exposed to high ozone levels are less valuable as a food resource for soil and stream organisms. Why would this be? It is known that the amount of nitrogen in leaf litter is a reliable predictor of the decomposition rate of that litter, with higher nitrogen levels leading to faster decomposition. The paradox is that there are higher-than-normal levels of nitrogen in ozone-exposed leaves, which should result in *more rapid* breakdown. The nitrogen in these leaves, however, appears to be unavailable to microbes, and, by extension, to insects, that would otherwise make them their meal.

When leaves are damaged, chemicals called phenolics are released by cells surrounding

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Dr. Findlay prepares partially decomposed cottonwood leaves for chemical analysis to examine changes in phenolic compounds.

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the damaged tissue to act as a kind of glue to repair cell walls and isolate the injury. A side effect of the presence of phenolics is a chemical change in the nature of cellular nitrogen. Ozone damages leaves by breaking down cell membranes. Phenolics are released and the consequence is clear: nitrogen present in the dead leaves is no longer in a form that is readily available for decomposer organisms.

Exposure to high amounts of ozone could have negative impacts on the forest ecosystem. Each autumn trees resorb nitrogen from their leaves as a normal part of the senescence process, thereby helping to maintain the tree's nutrient reserves. When nitrogen is tied up by phenolics as a result of ozone damage to leaves, it is not resorbed as efficiently. Also, when decomposition of fallen leaves is slowed, nitrogen is not returned to the soil ... and thus to trees and other plants ... as quickly as under normal conditions. Trees, therefore, could lose nitrogen on two fronts. So far, Dr. Findlay has been making his observations on leaves from cottonwood trees grown in the greenhouse and decomposed under laboratory conditions, and the situation in nature only can be hypothesized. However, if the impacts described above *do* occur in a forest ecosystem, there could be long-term effects as trees receive decreasing amounts of nitrogen and other nutrients.

Visitors to the Institute's greenhouse may have wondered about the function of the large, round plastic enclosure in one of the units. This is where Dr. Jones exposes young cottonwood trees to ozone in order to learn about the pollutant's effects on plant chemistry. Experimental plants receive a

single, four-hour dose of ozone at a concentration of 200 parts per billion — a level that occurs in the Dutchess County, N.Y. area only occasionally, but is relatively common in some parts of this country. The leaves that Dr. Findlay used in his decomposition experiments, then, had been exposed to ozone levels that are not excessive given today's environmental quality. It is important to learn whether or not plants in nature behave the same way as do the experimental cottonwoods.

Dr. Findlay and his collaborators* are hoping to do field studies to learn if any or all types of leaves show the same kinds of effects after natural ozone "events". Their plans call for collecting leaves from a variety of tree species at a number of different sites and separating them into damage classes based on measurements of the phenolics that they contain. Then they will observe decomposition in each class of leaf, assessing the quality of the leaves as food for microbes and decomposer insects and the quantity of nutrient return from the decayed leaf material. Data from these studies will help to determine the potential for long-term ecosystem damage from the effects of ozone pollution on leaves.

** Collaborating with Dr. Findlay are: Dr. Clive G. Jones, IES chemical ecologist; Dr. Vera A. Krischik, behavioral ecologist and IES visiting scientist whose research includes studies of plant defense; and Dr. Margaret M. Carreiro, a fungal ecologist at the Calder Ecology Center, Fordham University, and a member of the IES adjunct scientific staff.*

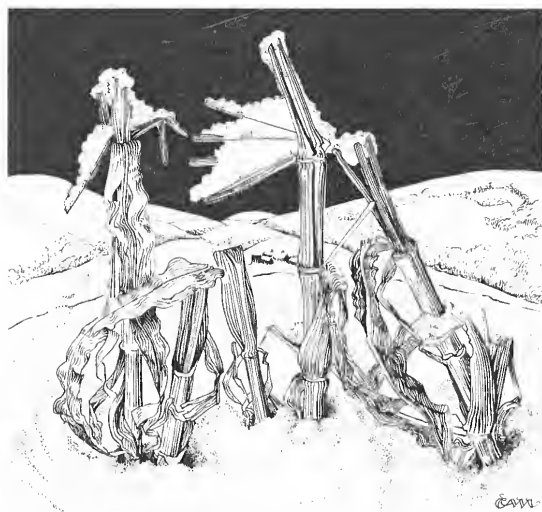
The evolution of this research project is similar to others at the Institute of Ecosystem Studies. One scientist's results lead to new questions and collaboration with a colleague. Recognizing that the best science is done by individuals seeking answers to questions that are both important and interesting, the Institute provides the freedom for such pursuit. In Dr. Findlay's case, the research also benefited from capable volunteers committing time to a new study for which there was as yet no regular staff.

"Good" vs. "Bad" Ozone

Why is it that when ozone is at ground level it is "bad", while when it is in the upper atmosphere it is "good"? In the July-August 1988 issue of this newsletter, Institute plant ecologist Dr. Gary M. Lovett wrote an article in which he addressed this often confusing question:

Ozone is potentially the most dangerous air pollutant that we measure. Ozone is a highly reactive form of oxygen that is formed when nitrogen oxides and hydrocarbons (air pollutants associated with urban areas) react in the presence of sunlight. Ironically, this ozone is the same substance that occurs naturally in the upper atmosphere and protects us from ultraviolet radiation. The "good" upper atmosphere ozone is being depleted by some pollutants (e.g., freons) at the same time other pollutants are creating harmful concentrations of ozone near the Earth's surface.

Cornfields at IES



The dairy farms of Millerton, New York were artist Carol Ann Morley's inspiration for *Cornfields*. Her work — approximately 30 pastel, colored pencil, and pen-and-ink drawings — currently is on display at the Institute.

Carol Ann Morley's professional career began with medical and natural science illustration, after she studied illustration at the Medway College of Art in England. For 15 years she has been adjunct associate professor of art at Pace University, and she developed and coordinates the Botanical Art and Illustration Certificate Program for The New York Botanical Garden in the Bronx. She has been a nature illustration

instructor with the IES Continuing Education Program since 1989, and this July will be teaching 'Drawing in the Garden' and 'Colored Pencil Workshop' at the Institute.

Cornfields is at the IES Plant Science Building, gracing the walls of the lobby and lunchroom. The exhibit is open weekdays, except public holidays, through May 28. Hours are 9 to 4, and admission is free.

Attention IES Members and Volunteers:

As you know, the reception planned to open *Cornfields* on Sunday, March 14 was canceled due to the snowstorm. Please come instead to a 'closing reception' on **Sunday, June 6 from 4:00 - 6:00 p.m.**

IES Ecologists Teach Intersession Course

Thirteen graduate and advanced undergraduate students in ecology spent their January intersession studying "Fundamentals of Ecosystem Ecology" at the Institute. The intensive program, coordinated by Dr. Gary M. Lovett, introduced the concepts, theories and history of ecosystem ecology and included lectures by Institute scientists on nutrient cycling, carbon and energy, and the responses of ecosystems to stress and disturbance. Institute ecologists also served as a resource for the students' final project on 'environmental issues'. This course is offered every other year; in 1989 it was coordinated by Dr. David L. Strayer and in 1991 by Dr. Stuart E.G. Findlay.

Participants in the 1993 program were: *Front row, l. to r.:* Manuel Contreras (Universidad de Chile); Gail Steinhart (Cornell University); Ted Floyd (Penn State

University); Dr. Gary M. Lovett, IES course coordinator; Sarah May (Duke University); Steven Brown (University of Mississippi); Philip Ficara (University of Connecticut)

Back row, l. to r.: Lisa Windham (Rutgers University); Ricardo Serrano (Universidad de Chile); Chris Hakenkamp (University of Maryland); Patti Anderson (City University of New York and The New York Botanical Garden); Ayn Whytemare (University of Washington); Emily Harwell (City University of New York and The New York Botanical Garden); Noel Gurwick (Cornell University)



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IES Notes



TOM TAFT

• In 1953, Richard A. Livellara took a job as a laborer at The New York Botanical Garden in the Bronx. Almost 20 years later, he joined the staff of the Garden's newly-opened Mary Flagler Cary Arboretum as a maintainer, and soon after the founding of the Institute of Ecosystem Studies at the Arboretum in 1983 was promoted to supervising maintainer. Recently he celebrated 40 years of employment, and on February 2 was honored at a surprise celebration at the Plant Science Building. There, Institute Director Dr. Gene E. Likens spoke of Mr. Livellara's contribu-

tions to the Garden, the Arboretum and the Institute, and presented him with a custom-made wristwatch — whose face is the IES logo — as well as other tokens of appreciation for four decades of outstanding work.

• Dr. Clive G. Jones has been promoted from associate scientist to scientist, in recognition of "continued excellence in scientific research (and) significant original contributions (through which he) has gained international recognition". Dr. Jones, a chemical ecologist, came to the Arboretum in 1980 to study interactions between plants and their insect pests. He expanded this research after the Institute opened, and his current work includes studies of the effects of pollution- and insect-induced stress and damage on plant resistance to disease and insect pests; of the intriguing ramifications of the simple snail-lichen-rock ecosystem of the Negev Desert in Israel; and of gypsy moth ecology and outbreaks.

• Microbial ecologist Dr. Peter M. Groffman joined the IES scientific staff in January 1992 and recently was promoted from assistant scientist to associate scientist. Dr. Groffman's research deals with the soil ecosystem — how microbes in the soil recycle nutrients and transform pollutants to harmless compounds, thereby improving groundwater quality — and with biosphere/atmosphere interactions.

• Dr. Juan J. Armesto, an associate professor at the Universidad de Chile in Santiago and an IES adjunct associate scientist, has been awarded the 1992 Manuel Noriega Morales Prize in the field

of biological science. This award, presented annually to a Latin American Scientist by the Inter-American Committee in Science and Technology of the Organization of American States in Washington, D.C., recognizes Dr. Armesto's contributions to plant community ecology, ecological biogeography and international scientific cooperation.

• Blizzard of '93: Research assistant Vicky Kelly is responsible for overseeing the operation of the IES Weather Station on Lovelace Drive. The data that she collected during the heavy snowstorm on the weekend of March 13-14 include the following ...

- Maximum wind speed:
17.2 meters/second (38.6 m.p.h.) at 10:16 a.m. on Sunday, March 14
- Minimum temperature, Sat., March 13:
-5.5 C (22.1 F) at 1:45 a.m.
- Minimum temperature, Sun., March 14:
-13.1 C (8.4 F) at 11:59 p.m.
- Precipitation:

The total amount of precipitation, measured in inches of water, was 1.9, which is roughly equivalent to a snow depth of 19 inches. The pH of the precipitation was 5.03, indicating that it was only very slightly acidified. The snow was less acid than usual because this was a coastal storm; most of the air pollutants contributing to acid rain come from the midwestern United States. (*Degrees of acidity or alkalinity are indicated using a logarithmic pH scale. On the scale of 0-14, vinegar, an acid, has a pH of approximately 3, and "neutral" is 7.0. The pH of "normal" precipitation is 5.6 or higher.*)

Spring Calendar

CONTINUING EDUCATION

Among the **spring semester** offerings are these new workshops and courses:

April 21 - May 26: **Botanical Watercolor Illustration**

May 1: **Pond and Lake Management and Restoration**

May 15 & 22: **Springtime Nature Photography**

June 12: **Implementing Integrated Pest Management in Landscapes and Nurseries**

Visit or call the Gifford House (number below) for a free catalogue describing these programs as well as courses in landscape design, gardening and botany. Also listed are the six IES ecological excursions planned for May and June.

SUNDAY ECOLOGY PROGRAMS

Free public programs are held on the first and third Sunday of each month, except over holiday weekends. Programs begin at 2 p.m. at the Gifford House on Route 44A unless otherwise noted. Call (914) 677-5359 to confirm the day's topic.

Apr. 18: **A Walk Up Teahouse Hill**, a walk led by Ana Ruesink

May 2: **Soils, Wetlands, the Ecosystem and Pollution**, a walk and demonstration led by Dr. Peter M. Groffman

May 16: **Ecology Treasure Hunt**, a walk led by Dr. Alan R. Berkowitz

June 6: **What's Up in the Woods?**, a walk led by Dr. Steward T.A. Pickett

June 20: **How Plants Defend Themselves**, a walk led by Dr. Clive G. Jones

Sunday Ecology Programs, continued

• *In case of inclement weather, call (914) 677-5358 after 1 p.m. to learn the status of the day's program. For outdoor programs, dress for the weather conditions, with long pants, socks and sturdy waterproof shoes.*

IES SEMINARS

The Institute's program of **scientific seminars** features presentations by visiting scientists. Free seminars are held at the Plant Science Building on Fridays at 3:30 p.m.

Apr. 16: **Causes and Consequences of Species Invasions: General Theory and Aquatic Case Studies**, Dr. D. Lodge, Univ. of Notre Dame

Apr. 23: **Individuality and Symbiosis**, Dr. L. Margulis, Univ. of Massachusetts at Amherst

Apr. 30: **Integrating Ecological and Social Dimensions of Forest Ecosystem Management**, Dr. L. Tritton, Univ. of New Hampshire

May 7: **Climate and CO₂ Change: Figuring Out the Consequences for Plants**, Prof. F.I. Woodward, Univ. of Sheffield, U.K.

May 14: **Latitudinal Patterns in Community Structure and Strategies of Herbivores**, Dr. Lauri Oksanen, University of Umeå, Sweden

GREENHOUSE

The IES greenhouse is a year-round tropical plant paradise as well as a site for controlled environmental research. The greenhouse is open until 4:00 p.m. daily except public holidays. Admission is by free permit from the Gifford House.

GIFT SHOP

Senior Citizens Days: On Wednesdays, senior citizens receive a 10% discount (except sale items).

Annual Perennial Sale: May 21 - 23. All plants are divisions from IES display gardens, and are discounted 10%. Gardeners will be on hand to answer your questions.

ARBORETUM HOURS

(Winter hours: October 1 - April 30; closed on public holidays)

Arboretum grounds are open Mon. - Sat., 9 a.m. - 4 p.m.; Sun. 1 - 4 p.m. Internal roads are closed when snow-covered or icy — call the number below for a report on trail conditions.

The Gift and Plant Shop is open Tues. - Sat., 11 a.m. - 4 p.m. and Sun. 1 - 4 p.m.

(Closed weekdays from 1 - 1:30 p.m.)

• *All visitors must pick up a free permit at the Gifford House Visitor and Education Center on Route 44A for access to the Arboretum. Permits are available until 3:00 p.m. daily.*

Note: Summer hours begin on May 1. The grounds will be open until 6 p.m., and permits will be available until 5:00 p.m.

MEMBERSHIP

Become a member of the Mary Flagler Cary Arboretum. Benefits include a member's rate for IES courses and excursions, a 10% discount on purchases from the Gift Shop and a free subscription to the IES Newsletter. Individual membership is \$30; family membership is \$40. For information on memberships, contact Janice Claiborne at (914) 677-5343.

For more information, call (914) 677-5359 weekdays from 8:30 - 4:30.

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